

# The deposit financing gap: Another Dutch disease

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**The deposit financing gap: Another Dutch disease**

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# The Deposit Financing Gap: Another Dutch Disease<sup>1</sup>

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## **Abstract**

In the last two decades the Netherlands have experienced an increase in real estate prices, accompanied by an increase in mortgages and a marked decline in household savings. As a consequence banks are faced with a large retail funding gap: outstanding mortgage debt is insufficiently matched by retail deposits, whereas other funding possibilities of banks have increasingly been constrained – also due to their large foreign exposures.

In this paper we argue that traditional macroeconomic models cannot analyse this phenomenon appropriately since they lack a proper model of the financial sector and underestimate the potential for interactions between the monetary and the real sphere. We present a stock-flow consistent approach developed by Godley and Lavoie as a valuable alternative to traditional and new Keynesian macroeconomic models and we use this approach to analyse the deposit financing gap for the Netherlands.

JEL codes: E44, B5, E6, G21

Keywords: stock-flow consistent modelling, retail funding gap, mortgage financing

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## 1. Introduction

In the years leading up to the financial crisis, the Netherlands have experienced an increase in real estate prices, partly due to government-induced tax incentives, accompanied by an increase in mortgages. In addition, the Netherlands are characterised by well-developed funded pension schemes that have resulted in substantial accrued compulsory savings. However, since the last two decades household savings have shown a marked decline, probably due to increasing wealth accumulation and the increasing importance of wealth effects on consumption over time. After the financial crisis, economic growth in the Netherlands, which is strongly dependent on export growth, has faltered. Moreover, due to the open nature of the Dutch economy the banking sector has a large foreign exposure, and also our compulsory savings are largely invested abroad. As a consequence of these developments banks are faced with a relatively large so-called retail funding gap or deposit financing gap: outstanding mortgage debt is insufficiently matched by retail deposits, whereas other funding possibilities of banks have increasingly been constrained.

The financial sector, which traditionally has a large foreign exposure, has become excessively vulnerable, partly due to its huge mortgage exposure. Amongst others this has contributed to a decline in consumer confidence and a large strain on the budget deficit. Moreover, the public has become increasingly aware of the fact that the Dutch economy was suffering from a housing bubble and house prices started to decline in the aftermath of the financial crisis and have only recently stabilised again. As a consequence consumption growth has become negative, fuelled by decreasing consumer confidence, drawing the economy into a double-dip recession. These developments might characterise a second Dutch Disease as we elaborate below.

To analyse these phenomena in a coherent framework, one needs a model which (1) shows the importance of wealth effects in consumption and a related model of wealth accumulation; (2) integrates the financial sector in the model, also showing its role in wealth accumulation; (3) integrates the housing market, also in relation to wealth accumulation; (4) allows for the relevant open economy characteristics of both export led growth and an exposed financial sector.

Traditional macroeconomic models, including the new Keynesian varieties, neglect the interaction of the real economy with the financial sector and the housing market, with the emphasis on wealth accumulation. However, the recent stock flow consistent approach, summarised in Godley and Lavoie (2007a), promises a very interesting alternative way to model these features in a coherent framework. In this paper we develop a model in this tradition which accounts for the stylised facts presented above. We also show how some relevant developments (like a further decline in house prices) or policy measures (like a decrease in mortgage tax reduction, increased capital requirements for the banking sector, expansionary government budget measures) affect the economy.

As a starting point we use the model developed by Zezza and Dos Santos (2006). They present a complete operational model in the stock flow consistent tradition which shows the importance of wealth effects in consumption, in relation to wealth accumulation, and takes into account the role of the financial sector. Zezza (2008) extended this model to include the interaction with the housing market. In our model we will elaborate these models by including relevant open economy characteristics and modelling the financial sector in a more elaborate way. We will show that the more elaborate modelling of the financial sector, also in an open economy context, is a necessary

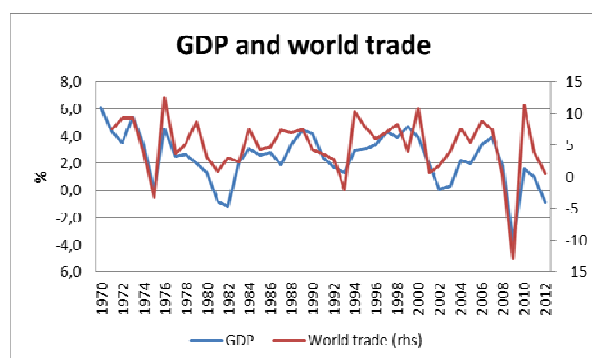
ingredient to explain the vulnerability of the financial sector, as appears for instance from the deposit financing gap, and the importance of its interaction with the real economy. The latter should also be analysed in relation to the development of government expenditures.

The remainder of this paper is set up as follows. In section 2 we discuss more in detail the relevant stylised facts of the Dutch economy to provide the background of our model specification. We present the model in section 3, with an emphasis on the elements which we add to the model developed by Zezza and Dos Santos (2006) by introducing the foreign sector, extending the model of the banking sector and including housing and mortgages in the household sector. The simulation results with the model are presented in section 4. We first show how the increase in house prices (kept exogenous in this initial version of the model) has led to the growth of the deposit financing gap and the strenuous situation of the financial sector, with negative spill-overs to the real economy. A simulation with decreasing house prices then shows the impact of the bursting housing bubble and the decline in economic growth. We also show that imposing a strict 3% budget deficit rule may impede the recovery process under some circumstances. Section 5 concludes this paper. Next to summarising the most important findings of our analysis, we discuss the limitations of our model and indicate the extensions we want to implement.

## 2. Stylised facts for the Dutch economy

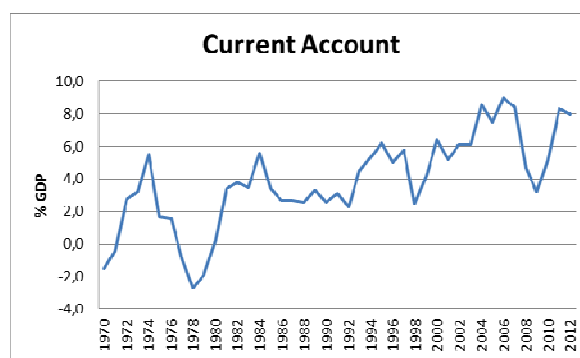
In this section we discuss some relevant stylised facts of the Dutch economy over the past years.<sup>2</sup> We deliberately take a longer time horizon to put the current situation in perspective.

Figure 1



Source: CPB (2013)

Figure 2



Source: CPB (2013)

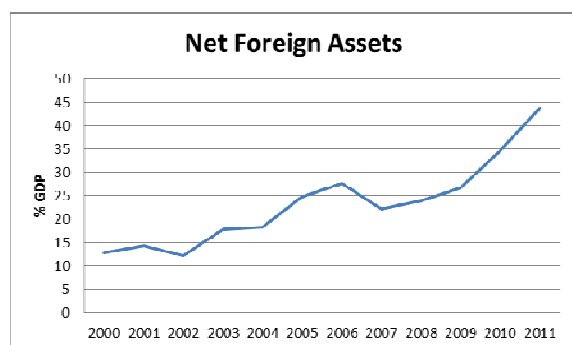
A first stylised fact is that economic growth is strongly dependent on export growth, as one can see from Figure 1. In 2012 total exports are almost 87% of GDP, of which 13% of GDP for energy and 43% for goods and services produced domestically – the remaining 30% are transition goods. The Netherlands traditionally has a current account surplus which since 2000 exceeds 6% of GDP (except in 2008 and 2009) – see also Figure 2. However, it is well documented that the current account surplus does not lead to a one-to-one increase in the net foreign asset position due to valuation

<sup>2</sup> We ignore here the problems of ageing for the economy, these will be introduced in a later version of the model, where we will also analyze the role of pension funds in the financial system.

changes (van den Dool and Hillebrand, 2013; Kool, 2010). Figure 3 shows the recent development of the Dutch net asset position, which increased towards 40% of GDP in recent years.

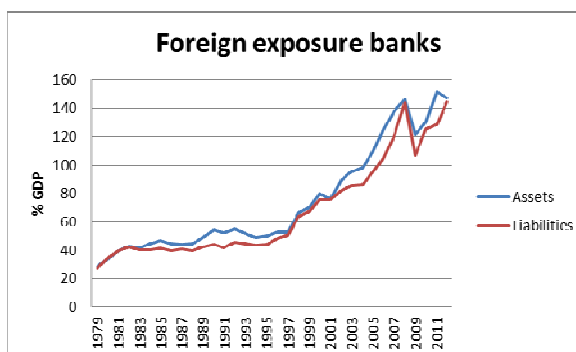
The relatively modest net asset position of the Dutch economy hides the fact that the open nature of the Dutch economy has led to a considerable foreign exposure of the Dutch banking system as is illustrated in Figure 4. One sees that after an average exposure of around 40% of GDP till the mid-1990s, foreign exposure more than tripled in the next decade relative to GDP. In terms of total banks assets the share increased from about 35% in 1998 till 70% in 2011.

Figure 3



Source: World Bank statistics

Figure 4



Source: BIS statistics

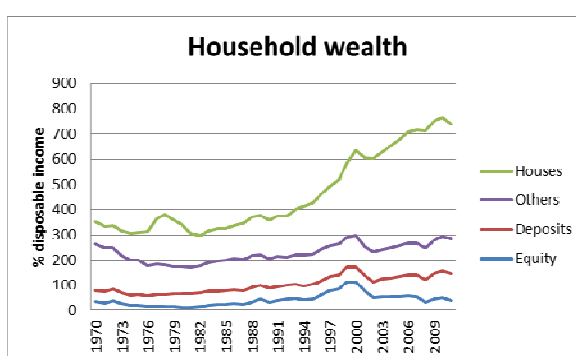
The second stylised fact is that there has been a structural decline in household savings relative to disposable income since the early 1990's – compare Figure 5 below.<sup>3</sup> This can be explained by the increasing importance of wealth effects on consumption over time. Figure 6 shows how household wealth has more than doubled relative to disposable income since the early 1990s; this is in particular due to the large increase in house prices. The latter is illustrated in Figure 7 from which one can see that the average house price more than doubled in the decade between 1995 and 2005 and it reached a peak in late 2008, after which house prices started to decline.

Figure 5



Source: CPB (2013)

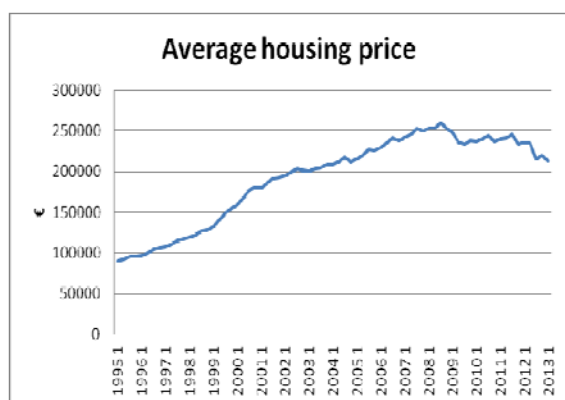
Figure 6



Source: CPB (2013), cumulative series

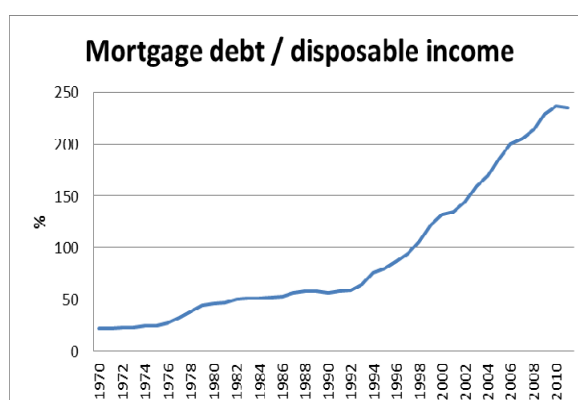
<sup>3</sup> What we do not elaborate here is that in the Netherlands there is an important distinction between collective savings for the funded pension system, which are relatively stable around 8% of disposable income, and individual savings. The decline in the latter is responsible for the decline of household savings rate observed in Figure 1. Retained profits did increase, keeping the total private savings rate more or less constant at a level of 25% of GDP.

Figure 7



Source: CBS statistics

Figure 8

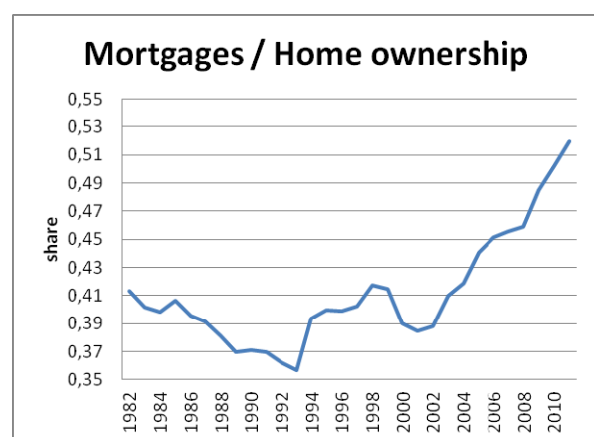


Source: CPB (2013)

The burst of the housing bubble and the decline in consumer confidence are partly explained by the increasing awareness of the huge exposure of Dutch households to mortgage debt, as also appears from Figure 8. This exposure has been recognised for some years in assessments of the Dutch economy by institutions like the IMF and the OECD (IMF, 2011, 2013; OECD, 2012) and later also in the Dutch debate.<sup>4</sup>

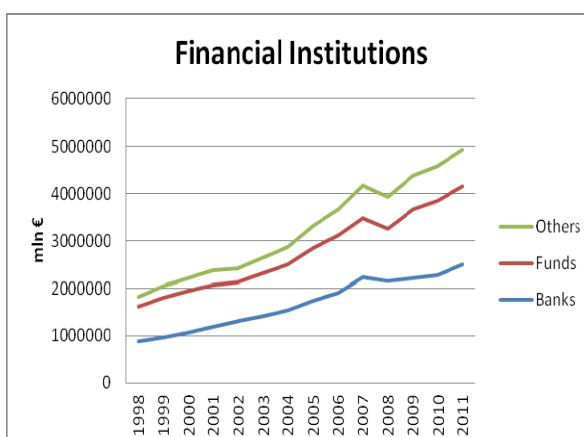
Recently consumption growth has been negative due to a decline in house prices and low confidence, drawing the economy into a double-dip recession. This also explains the upswing in household savings in the last years in Figure 5 – this upswing is predicted to continue for the coming years.

Figure 9



Source: CBS statistics

Figure 10



Source: DNB statistics, cumulative series

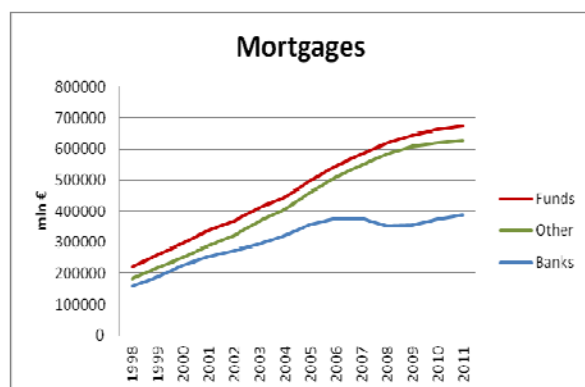
The third stylised fact is that the financial sector, which traditionally has a large foreign exposure (IMF 2011, Box 1 and Figure 4 above), has become excessively vulnerable, partly due to its huge mortgage exposure. Whereas Figure 8 shows the expansion of mortgages relative to disposable income, Figure 9 shows that mortgages also increased relative to housing wealth since the early

<sup>4</sup> The Dutch central bank, for instance, has in the run-up to the crisis continuously pointed out the vulnerabilities of the Dutch economy to developments in the housing markets as witnessed by the bank's annual reports.



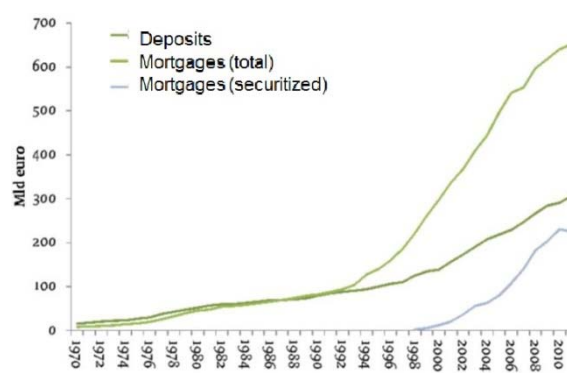
2000s. Initially this reflects an increasing eagerness of banks and other institutions to provide mortgages, in combination with tax advantages which allows interest paid on mortgages to be deducted from the pre-tax annual income. From 2007 the further increase also reflects decreasing house prices, which by definition increase the ratio of mortgages relative to housing wealth. One also sees from Figure 10 that the financial sector does not only consist of banks, but that pension funds also play an important role – this reflects the important role of funded pensions in the Dutch pension system.<sup>5</sup> The other financial institutions are mainly insurance companies. Figure 11 shows that they have taken over the issuing of mortgages from banks since 2006.<sup>6</sup>

Figure 11



Source: DNB statistics, cumulative series

Figure 12 Deposit Financing Gap



Source: CPB (2012), Figure 5

The combination of increased mortgages and a moderate development of deposits resulted in an enhanced vulnerability of the banking system to the vagaries of the international financial markets. Whereas deposits are generally seen as a secure and stable source of funds, the increasing gap between long-term commitments and funds has been recognised as the deposit financing gap (Vandevyvere & Zenthöfer, 2012) which is depicted for the Netherlands in Figure 12. The figure illustrates how till 1992 mortgage financing was mainly through deposits, but the acceleration in mortgage debt since the early 1990s could no longer be financed by deposits and since the mid-1990s debt securitisation became an increasingly important source of financing. In its 2013 assessment of the Dutch economy the IMF recognises this as the most important vulnerability of the Dutch economy (IMF, 2013) and also the OECD pays special attention to this phenomenon in a recent assessment of the Dutch economy (OECD, 2012, Box 2). The increasing awareness of these problems in the public debate in the Netherlands has resulted in a decline in consumer confidence. Moreover, the fourth largest bank of the Netherlands had to be nationalised due to funding problems in 2013.<sup>7</sup> Obviously this has put a strain on government debt.

As we already mentioned earlier, given the open nature of the Dutch economy, the long-term interest rate is determined abroad. As one can see from Figure 13, from the early 1990s inflation has stabilised around 2% after the recovery process of the oil price shocks. The decline in the nominal

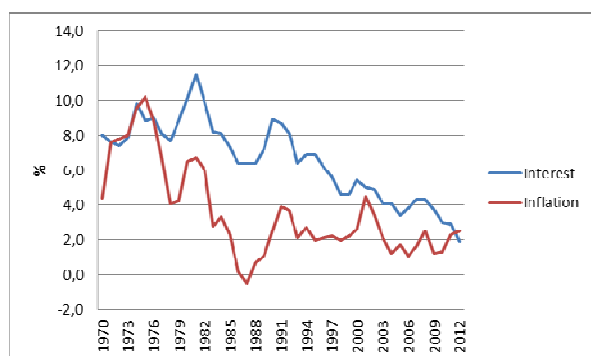
<sup>5</sup> See note 2 above.

<sup>6</sup> The reason is that bank regulation has tightened relative to regulation of insurance companies and capital requirements for insurance companies are less stringent.

<sup>7</sup> This refers to the SNS-bank. The second largest bank (ABN/AMRO) is already effectively nationalized and the third largest bank (ING) is also indebted to the government, due to earlier interventions.

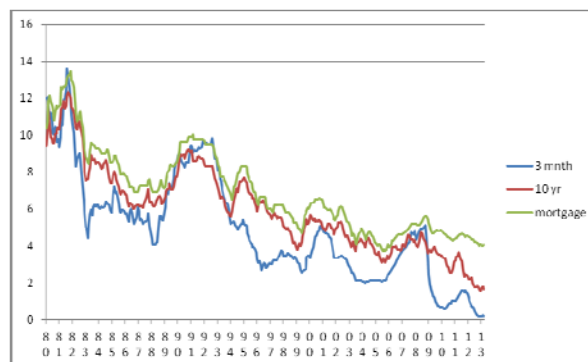
long-term interest rate therefore also occurred in the real interest rate since the early 1990s. Figure 14 shows the development of the mortgages rate in relation to the relevant interest rates.

Figure 13 Long-term interest rate and inflation<sup>8</sup>



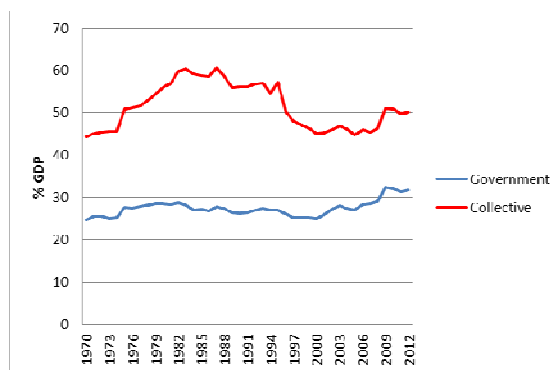
Source: CPB (2013)

Figure 14 Interest rates



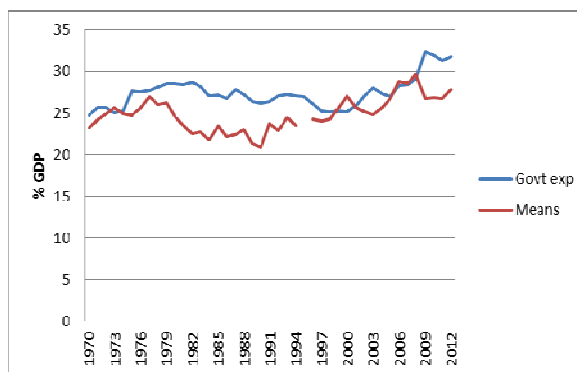
Source: DNB statistics

Figure 15 Collective and government expenditures



Source: CPB (2013)

Figure 16 Government expenditures and means



Source: CPB (2013)

One sees that the 10 years government bonds rate follows the long-term interest rate depicted in Figure 13. The mortgage rate is on average 1 percentage point higher, but the mark-up widened considerably after the financial crisis till almost 2.5 percentage points.<sup>9</sup> One also sees that the mortgage rate follows the long-term interest rate much closer than the short-term interest rate; the latter also fluctuates more strongly.

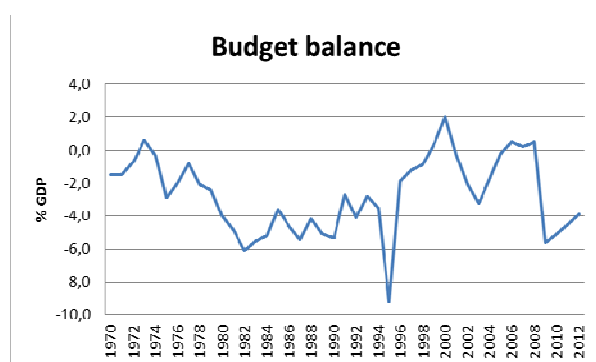
The fourth stylised fact is that the Netherlands, like most other European countries, has a relatively high share of government expenditures. In that respect one should distinguish between all expenditures made by the government, these 'collective expenditures' include for instance transfers for social security, and government expenditures which are counted as value added in the national accounts. Figure 15 shows that the collective expenditures are about 50% of GDP, whereas the 'pure' government expenditures are about 30% of GDP. Since we abstract from social security transfers in

<sup>8</sup> The long-term interest rate is a weighted average of the 10 years interest rates of Germany and the US. Inflation is based on CPI

<sup>9</sup> This has been explained by the lack of competition after the various state interventions after the financial crisis (CPB, 2012; NMA, 2010). An alternative explanation, focusing on the financing problems following from the deposit financing gap is provided by Jansen et al. (2013). Also take into account that there is a break in the mortgages series: till 2006 the series refers to the average rate of outstanding mortgages, thereafter it refers to new mortgages.

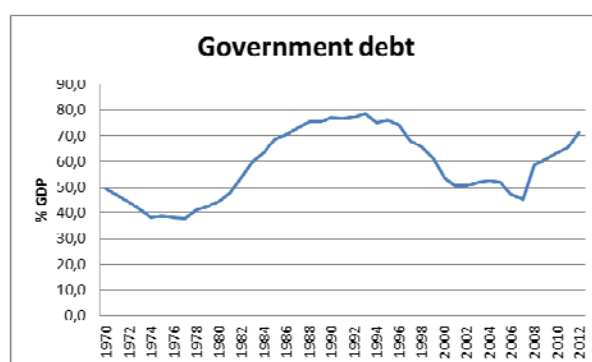
the current version of our model, we will only look at the ‘pure’ government expenditures. However, the budget deficit, which accumulates in government debt, is related to the collective expenditures. To get an impression of the development of taxes, we have created an artificial time series of government means by subtracting the budget deficit from the pure expenditures – both series are presented in Figure 16, and the corresponding deficit is presented in Figure 17. An interesting observation is that in spite of efforts of recent governing coalitions, the pure government expenditures show a tendency to increase since 2000. The budget deficit shows a typical countercyclical pattern, as Figure 17 shows.<sup>10</sup> The current governing coalition is making strong efforts to bring this under the Maastricht norm of 3% of GDP. Finally Figure 18 shows the development of government debt. As is well documented it is increasing, notably due to the problems in the banking sector, but it has not yet reached its previous peak of the early 1980s.

Figure 17



Source: CPB (2013)

Figure 18



Source: CPB (2013)

### 3 A stock-flow consistent model for the Dutch economy

Our analysis takes as a starting point the model developed by Zezza and Dos Santos (2006), indicated by ZDS below. They present an operational model in the stock flow consistent tradition which shows the importance of wealth effects in consumption, in relation to wealth accumulation, and takes into account the role of the financial sector. Zezza (2008), referred to as Zezza in the remainder of this paper, extends this model to include the interaction with the housing market, which is highly relevant for our analysis.<sup>11</sup> In our model we will expand these models by including relevant open economy characteristics and modelling the financial sector in a more elaborate way. However, we model the housing market differently, with endogenous house prices while keeping the stock of housing exogenous. We show that the more elaborate modelling of the financial sector, also in an open economy context, is a necessary ingredient to explain the vulnerability of the financial sector, as appears for instance from the deposit financing gap.

In this section we present the elements which we add to the model developed by ZDS by introducing the foreign sector, extending the model of the banking sector and including housing and mortgages in the household sector. Next we briefly summarise the models of firm behaviour and government,

<sup>10</sup> The peak in 1995 is due to a statistical revision of the data.

<sup>11</sup> Zezza also pays considerable attention to including the role of the distribution of income between wages and profits in his model. We ignore that aspect here.

which are identical to those of ZDS. The full model is presented in the Appendix and the balances presented for each sector are summarised in the balance sheet for the total economy at the end of this section, together with the social accounting matrix which summarises all transactions – see Tables 6 and 7 below, respectively.

### 3.1 *The foreign sector and the Central Bank*

The foreign sector is introduced in a simple way, following Godley and Lavoie (2007b). Next to consumption, investment and government goods, firms also produce net-exports ( $X - IM$ ). This does not affect their balance sheet, however, nor does it affect their flow of funds. We assume exports  $X$  to be exogenous and imports  $IM$  to be proportional to GDP. Initially Godley and Lavoie do not discuss terms of trade and exchange rate issues. Here, we follow their ignorance of these issues – partly motivated by the knowledge that a lot of trade by the Netherlands is within the euro area.

Since foreigners hold both bank equity ( $p_e.E_{ba}$ ) and bonds ( $B_{ba}$ ) issued by banks, as we discuss in the next section, these appear as assets in the balance sheet of the foreign sector. The liabilities of the foreign sector consist of foreign reserves ( $R$ ) held by the Central Bank. Changes in these foreign reserves occur because of net exports and financial transfers due to dividends payments out of bank equity and interest payments on bonds, as we discuss in section 3.6. The balance sheet of the foreign sector is given in Table 1 below.

Table 1 Balance sheet of the foreign sector

ASSETS	LIABILITIES
Bonds ( $B_{ba}$ )	Foreign Reserves ( $R$ )
Equity ( $p_e.E_{ba}$ )	Total (net worth) ( $Va$ )

Foreign reserves are assets in the balance sheet of the Central Bank. In the present analysis we ignore the complications which follow from the fact that the euro area, including the Netherlands, is controlled by the European Central Bank and not by a National Central Bank – but including a Central Bank balance sheet is necessary for a proper modelling of the financial sector and the consistency of our analysis. We will use the ‘neutral’ term Central Bank in our analysis and refer to the ECB whenever appropriate.

Next to holding foreign reserves, the Central Bank provides advances  $A$  to banks and holds bills issued by the government,  $B_c$ . The liabilities are high powered money  $H$  issued by the Central Bank, which is held by the public and banks. Since the revenues of the Central Bank,  $FC$ , are transferred to the government, the balance sheet of the Central Bank is closed without remaining net worth. As a consequence, the Central Bank balance sheet now looks as presented in Table 2.

Table 2 Balance sheet of the Central Bank

ASSETS	LIABILITIES
Advances to Banks (A)	High powered money (H)
Treasury Bills ( $B_c$ )	
Foreign Reserves (R)	

The revenues of the Central Bank are given by:

$$FC = i_{A,-1} \cdot A_{-1} + i_{B,-1} \cdot B_{c,-1} \quad (1)$$

Here  $i_B$  is the rate on government bills set by the Central Bank, and  $i_A$  is the interest rate on advances. The latter is set as a mark-up on inflation such that the real interest rate on advances is a constant.<sup>12</sup> In line with ZDS, Zezza and Godley and Lavoie (2007a) we assume that supply of bills by the government is cleared by the Central Bank.<sup>13</sup> The amount of advances provided by the Central Bank is discussed in the next section. Finally, the Central Bank provides as much high powered money as is demanded by banks and households.

As Godley and Lavoie (2007b) emphasise, there is no inherent mechanism for a country with a trade surplus to converge to a balanced current account, as long as it is willing to accumulate ever more foreign debt. This situation is quite relevant for the Netherlands. See our discussion of stylised fact 1 in section 2.

### 3.2 The bank balance sheet and the deposit financing gap

The bank balance sheet in ZDS contains the following items:

Assets: Cash ( $H_b$ ) + Loans to firms (L) + Mortgages (MO) + Treasury Bills ( $B_b$ )

Liabilities: Bank deposits (M) + Central Bank advances (A)

If we compare this to the simplified balance sheet of an ordinary bank, we note that in the ZDS approach interbank lending is ignored – this is a reasonable simplification. The latter also holds for simplification by ZDS that banks are assumed not to hold treasury bills ( $B_b=0$  – all bills are held by the Central Bank).<sup>14</sup> However, an important omission is that in ZDS the bank does not own capital. The

<sup>12</sup> This is in line with the assumptions of ZDS and Zezza, in a later version of the model we will introduce a Taylor rule and also experiment with a zero nominal interest rate.

<sup>13</sup> Obviously this is a simplifying assumption since the ECB is not allowed to do this. However, Draghi's famous statement that he will do "everything" to protect the Eurosystem against speculation comes close to this notion.

<sup>14</sup> In line with Godley and Lavoie (2007a, Ch. 10), Zezza assumes that bank's demand for bills is a fixed proportion of deposits ( $B_b = \psi_1 \cdot M$ ) and banks have a liquidity reserve requirement imposed by the Central Bank

latter seems very strange in the light of our analysis in which banks finance their assets by borrowing from the financial sector, which we model by issuing equity and bonds abroad.<sup>15</sup> Equity is such that the leverage ratio, which is tier 1 capital / risk-unweighted long lending, should exceed a certain threshold. As a consequence, tightening of capital requirements forces banks to either issue equity (which they usually are reluctant to do) or reduce their outstanding loans on the asset side. In line with ZDS and Zezza, all profits of the banking sector are distributed to the households – we interpret these as bonus payments in excess of normal wages.<sup>16</sup> However, In case of losses no profits are distributed to the households and equity is issued to compensate for these losses.

Hence we add compared to ZDS to the bank balance sheet Mortgages ( $MO$ ) as bank assets, which are issued to the public to finance their housing, and Bonds ( $B_{ba}$ ) and Equity ( $p_e.E_b$ ) as liabilities, which are held by the foreign sector and used by banks to finance their outstanding mortgages and loans. Here  $p_e$  is the nominal price for equity. The resulting balance sheet is presented in Table 3.

Table 3 Balance sheet of the banking sector

ASSETS		LIABILITIES	
Cash ( $H_b$ )		Deposits ( $M$ )	
		Advances Central Bank ( $A$ )	
Long lending	<ul style="list-style-type: none"> <li>mortgages (<math>MO</math>)</li> <li>firms (<math>L</math>)</li> </ul>	Bonds ( $B_{ba}$ )	
		Capital (tier 1)	Equity ( $p_e.E_{ba}$ )

Having added three variables to the balance sheet and their prices, we have to model these. We maintain the assumption made by ZDS that for issuing deposits banks need to meet the reserve requirement:

$$H_b = v.M \quad (2)$$

In line with Zezza, we assume that the demand for mortgages by households is fully accommodated by banks at a rate which is a fixed mark up on the rate on advances. Hence both the amount of mortgages and the price of mortgages are given to the banking sector. With respect to equity, we assume that the price of equity equals that determined for firms, hence that is also given for the banking sector. The same does hold for dividend payments: we impose on banks the dividend paid by

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( $H_b = \psi_2.M$ ), if then internal funds are not sufficient to satisfy the demand for loans, banks get advances from the central bank. We follow the latter approach, as we elaborate below.

<sup>15</sup> Bonds represent here all sources of outside financing. That banks borrow exclusively abroad is a simplifying assumption, which however emphasizes the stylized fact of strong foreign exposure of the Dutch financial sector. See Figure 4 above.

<sup>16</sup> The profits are given by  $[(1 - \text{tax rate}) * (\text{income from lending} - \text{costs of borrowing}) - \text{dividends on equity}]$ . We ignore retained profits which can contribute to internal funds, as a consequence net worth of banking is zero.

firms. The amount of equity is, in line with our analysis, a fixed proportion of the total liabilities of the banking sector – determined by the Basel requirements. Bonds are available from the foreign sector at a relatively high rate, in principle to an unlimited amount. The banks' balance sheet then is closed by the amount of advances by the Central Bank and bonds ( $A + B_{ba}$ ). We assume that there is a ratio between advances and deposits, implicitly imposed by the Central Bank, and the remaining gap is financed by borrowing from abroad.<sup>17</sup>

With respect to the pricing decisions, we assume in line with the ZDS analysis that the interest rates on loans and deposits are set as a fixed mark-up on the rate on advances set by the Central Bank. Similarly, the rates on mortgages and bonds issued are fixed mark-ups on the interest rate on treasury bills. Endogenising these mark-ups consistent with the analysis of Godley and Lavoie (2007a, Ch. 10) is left for further research.

An important property of our extension of the ZDS/Zezza model is that it allows us to identify the deposit financing gap as the discrepancy between  $M$  and  $L + MO$ . As we discussed in the previous section, this gap is considered to be problematic since the larger the gap is, the more banks have to rely on outside capital to finance their loans. In particular in the case of mortgages this is problematic, since mortgages are outstanding long-term commitments and outside capital is of shorter duration and more risky (often foreign). This implies that the larger the deposit financing gap is, the more expensive financial resources for banks become. If the financing by bonds requires a rate  $r_b$  and deposits are paid a rate  $r_d$ , the problem for banks is that holds  $r_b > r_d$ . This implies that the return of capital to finance loans ( $L_{ba} = M + B_{ba}$ ),  $r_v$ , is given by:

$$r_v = r_b \cdot B_{ba} / L_{ba} + r_d \cdot M / L_{ba} \quad (3)$$

and one immediately sees that  $r_v$  increases with  $B_{ba} / L_{ba}$  – i.e. when the deposit financing gap increases.<sup>18</sup> It is obvious from our modelling of bank behaviour that an increase in mortgages issued at a given amount of deposits will automatically lead to an increase in the deposit financing gap.

### 3.3 *Including housing and mortgages in the household model*

When including housing and mortgages in the model, we follow Zezza's structure. However, we do not use his distinction between rich and poor households, but maintain one household sector. Moreover, we ignore for simplicity the renting of houses. The resulting balance sheet of households is presented in Table 4.

<sup>17</sup> This was the case till recently. In the current situation the foreign sector is rationing the available amount of credit, and the European Central Bank provides an unlimited amount of advances.

<sup>18</sup> In a later version of the model we will also use  $r_v$  as the rate on which the mortgage rate is based with a mark-up. The mark-up is influenced by default risk on the one hand and demand pressure on the other.

Table 4 Balance sheet of the household sector

ASSETS		LIABILITIES	
High powered money	$+ H_h$	Mortgages	$+ MO$
Bank deposits	$+ M$		
Bills	$+ B_h$		
Equities	$+ p_e.E_h$		
Homes	$+ ph.HS$		
		Total (net worth)	$+ V$

In determining demand for housing we follow Madsen (2013), who states that when banks and households decide on a loan for buying a house, the affordability of the household determines the maximum loan the bank is willing to provide. The affordability  $\psi$  is the total amount of housing costs that the household is willing and able to spend, relative to its disposable income. Since  $\psi$  is a given parameter, house prices are determined on the demand side by user costs, income and the housing stock (Masden, 2013). Important issues here are that in contrast to conventional models the user costs take into account both tax reliefs on mortgage payments and financial innovations, the latter resulting for instance in a lower repayment rate of mortgage loans. The user costs also assume money illusion, since the nominal interest rate is used. This is in line with Zessa's approach to house prices. A second element is that the income variable is a geometrically weighted average of current disposable income and expected income, the latter including lagged house prices to indicate potential capital gains. Finally, it is important to note that all variables are in nominal terms (as is also the case in Zezza). This implies that the growth rate of the house price follows from:

$$\Delta \ln P_t^h = \psi_t + \alpha \Delta \ln Y_t^h + (1 - \alpha) \Delta \ln Y_t^e - \Delta \ln [i_{MO}(1 - \tau_h \tau_{MO}) + f_{MO}] - \Delta \ln HS_t \quad (4)$$

where  $Y_t^h$  is disposable income (not net of mortgage payments),  $Y_t^e$  is expected income for next year. The one but last term refers to the user cost of (housing) capital and includes the interest rate on mortgages ( $i_{MO}$ ) corrected for the fraction that is deductible for income tax, and the mortgage repayment rate ( $f_{MO}$ ). The fraction that is deductible from income tax is given by the income tax rate ( $\tau_h$ ) times the fraction of mortgage interest payments that is deductible ( $\tau_{MO}$ ). The final term in the above equation refers to the number of houses on the market,  $HS$ . We assume housing supply  $HS$  to be given, due to the highly regulated housing market in the Netherlands.

An important aspect is that Masden (2013, p. 23) argues that "... past house prices can influence the  $\psi_t$ -term as banks may be willing to increase the fraction of income that is used for mortgage payments in periods of increasing house prices." As a consequence both increasing house prices and growing income can cause an outward shift in the demand curve for housing and help to model a boom – and a fall in the opposite case. In our simulations we will show how changes in  $\psi$  can cause bursting housing bubbles.

Once the share of assets to be spent on housing is determined we assume that, in line with ZDS, the remaining demand for assets  $H_h$ ,  $B_h$  and  $E_h$  follow from a Tobin-type portfolio model. Then bank



deposits  $M$  are determined as a residual of household wealth. This implies that wealth net of housing and mortgages:<sup>19</sup>

$$VN = V - (ph.HS - MO) = H_h + M + B_h + p_e.E_h \quad (5)$$

is distributed over its assets components as follows:<sup>20</sup>

$$H_h = v_1.p.C \quad (6)$$

$$p_e.E_h / (VN^e - H_h) = \lambda_{00} - \lambda_{01}.r_M^e + \lambda_{02}.r_E^e - \lambda_{03}.Yhd^e/V^e - \lambda_{04}.r_B^e \quad (7)$$

$$B_h / (VN^e - H_h) = \lambda_{10} - \lambda_{11}.r_M^e - \lambda_{12}.r_E^e - \lambda_{13}.Yhd^e/V^e + \lambda_{14}.r_B^e \quad (8)$$

$$M = VN - H_h - B_h - p_e.E_h \quad (9)$$

The expected values of variables are based on an adaptive expectations mechanism:

$$X^e = X_{-1} + \xi.(X^e - X_{-1}) \quad (10)$$

With respect to demand for mortgages we simply assume for the moment being that they are a fixed proportion of the housing value, while we assume supply of mortgages to be accommodating.<sup>21</sup> Hence:

$$\Delta MO = \varphi.ph.\Delta HS + \varphi.\Delta ph.HS - morc \quad (11)$$

Household savings are defined as the disposable income of households  $Yhd$  minus consumption  $C$ :<sup>22</sup>

$$Sh = Yhd - p.C \quad (12)$$

We redefine the disposable income of households by also deducting interest payments on mortgages:<sup>23</sup>

$$Yhd = Yh - Td - i_{MO,-1}.MO_{-1} \quad (13)$$

where  $Yh$  is household income and  $Td$  are taxes paid by households, defined by:

$$Yh = WB + FD + i_{M,-1}.M_{-1} + FB + i_{B,-1}.B_{h,-1} \quad (14)$$

$$Td = \tau_h.(Yh - \tau_{MO}.i_{MO,-1}.MO_{-1}) \quad (15)$$

<sup>19</sup> Surprisingly enough Zezza ignores the role of mortgages in his definition of  $M$ .

<sup>20</sup> Restrictions on lamda are hardly relevant, except  $\lambda_{00} + \lambda_{10} < 1$ , because bank deposits act as a buffer to wrong expectations – see Zezza (2008) for an elaboration of this point.

<sup>21</sup> From Figure 9 one sees that from 1982 till 2002 mortgages were very close to 40% of housing value in the Netherlands, since then they increased gradually to above 50% nowadays. Zezza, who also assumes that mortgage supply is accommodating, models demand for mortgages as the difference between demand for homes and saving being financed by the net increase in new bank mortgages. However, he does this for workers, for whom in his model the only outlet for savings is to invest them in houses.

<sup>22</sup> In a next version of our paper we will introduce compulsory pension savings. Be aware that about 8% of Dutch disposable income are ‘collective savings’, while ‘individual savings’ have been falling sharply from a height of 8% in the mid-1980s and have become negative in 2000 and consistently negative since 2003 – see also Figure 5 above.

<sup>23</sup> Zezza does not deduct these interest payments from disposable income.

Where  $\tau_h$  is the tax rate on income and  $\tau_{MO}$  is the tax reduction on interest payments – the latter play an important role in explaining the high incidence of mortgages in the Netherlands.

In line with ZDS we assume that households' consumption depends on real disposable income, the opening stock of wealth  $V$ , and real capital gains.<sup>24</sup> Capital gains can be obtained on the stock of equity, the only financial asset with a market price, and on housing. Contrary to Zezza, we assume the stock of housing to have a different impact on consumption compared to financial wealth, due to its differences in liquidity.<sup>25</sup> However, in line with Zezza, capital gains on housing are assumed to have the same impact as those on equity. As a consequence the consumption function is given by:

$$C = \alpha_1 \cdot y_{hd} + \alpha_2 \cdot v_{-1} + \alpha_3 \cdot (ph \cdot HS - MO)/p + \alpha_4 \cdot (cge^e + cgh^e - [g_p^e/(1 - g_p^e)] \cdot v_{-1}) \quad (16)$$

where small letters for variables indicate real values, f.i.  $y_{hd} = Y_{hd}/p$ . The capital gains are defined by:<sup>26</sup>

$$CGE = \Delta p_e \cdot E_{-1} \quad \text{and} \quad CGH = \Delta ph \cdot HS_{-1} \quad (17)$$

The change in household wealth then follows from:

$$\Delta V = Sh + CGE + CGH \quad (18)$$

Finally, the increase in housing should be included in the production of firms, which appears in the capital balance of the social accounting matrix - see Table 7 below.

### 3.4 Firm behaviour and wage and price formation

We follow ZDS in modelling both wage and price setting and firm behaviour. The model is kept deliberately simple since the focus is on the interaction with the financial sector. Price  $p$ , net of indirect taxes  $t_i$ , is set as a mark-up  $\rho$  on unit labour cost. The latter are defined as wages  $w$  relative to labour productivity  $\pi$ . Hence:

$$p \cdot (1 - t_i) = (1 + \rho) \cdot w / \pi \quad (19)$$

Nominal wage growth,  $g_w$ , equals expected inflation,  $g_p^e$ , plus expected productivity growth,  $g_\pi^e$ , although the latter might not be fully accounted for. Hence:

$$g_w = g_p^e + \chi_1 \cdot g_\pi^e \quad (20)$$

Labour productivity is determined exogenously.<sup>27</sup> Given labour productivity, demand for labour  $N$  follows from:

$$N = Y / \pi \quad (21)$$

<sup>24</sup> However, we ignore different propensities to consume out of income for the three groups in the economy (assuming that the propensity to save for owners of equities and recipients of bank profits is higher than that for wage earners).

<sup>25</sup> See also CBP (2012).

<sup>26</sup> The term  $- [g_p^e/(1 - g_p^e)] \cdot v_{-1}$  is valuation gain on wealth, with  $g_p^e$  as expected inflation.

<sup>27</sup> Zezza assumes that the growth of labor productivity is negatively influenced by capacity utilisation.

Profits of the firms are given by:

$$FT = Y - WB - Ti \quad (22)$$

Part of what then results after interest payments and profit taxes is kept as retained earnings, and the remaining part is paid out as dividend to households (provided it is positive).

We ignore in this version of the model the determination of unemployment and its potential interaction with wage determination and social security expenditures.<sup>28</sup> That is left for further research.

Investment of firms is an important ingredient of the model because of its impact on both aggregate demand and on productive capacity. Investment is determined by four variables. First the cash-flow rate,  $r_{fc}$ , which is a source of self-financing of investment. The latter depends on retained earnings,  $FU$ , which is a fixed proportion of profits,  $FT$ , net of interest payments and taxes. Hence we find:

$$FU = \phi \cdot [(1 - t_i) \cdot FT - r_{L-1} L_{-1}] \quad (23)$$

$$r_{fc} = FU / (p \cdot K_{-1}) \quad (24)$$

The second determinant of investment is the interest payments on the leverage ratio,  $lev$ :

$$lev = L / (p \cdot K_{-1}) \quad (25)$$

The third determinant is Tobin's  $q$ :

$$q = (L + p_e \cdot E) / (p \cdot K_{-1}) \quad (26)$$

and the fourth determinant is the utilisation rate,  $u$ , with normal utilisation defined at  $u^*$ :

$$u = Y / (\kappa \cdot K_{-1}) \quad (27)$$

As a consequence we find for the growth of the capital stock:

$$g_K = \gamma_0 + \gamma_1 \cdot r_{fc-1} - \gamma_2 \cdot r_{L-1} \cdot lev_{-1} + \gamma_3 \cdot q_{-1} + \gamma_4 \cdot (u_{-1} - u^*) \quad (28)$$

From the above it follows that the sources of financing investment are next to retained profits, loans and equity. This also is consistent with the balance sheet of firms as presented in Table 5.

Table 5 Balance sheet of firms

ASSETS		LIABILITIES	
Capital	$+p \cdot K$	Loans	$+L$
		Equity	$+p_e \cdot E_h$
		Total (net worth)	$+V_f$

<sup>28</sup> This is in line with ZDS. Zezza recognizes the potential impact of unemployment on wage formation by relating the parameter  $\chi$  in the wage equation negatively to unemployment. However, he ignores the interaction with social security contributions and unemployment benefits.

Retained earnings have already been modelled in equation (23) above. With respect to equity we assume that new equities are issued as a fixed proportion of the amount of external funds required to finance investment:

$$p_e \cdot \Delta E_h = \epsilon \cdot (p \cdot \Delta K - FU) \quad (29)$$

Bank loans then are used to close the remaining financing gap:

$$\Delta L = p \cdot \Delta K - FU - p_e \cdot \Delta E_h \quad (30)$$

As ZDS show these last two equations determine the equilibrium value of  $p_e$ .

### 3.5 *The government*

Growth in government expenditures is modelled in line with ZDS to equal expected output growth

$$g_G = g_K \quad (31)$$

and taxes are proportional to the relevant bases. Hence we have:

$$Td = \tau_h \cdot (Y_h - \tau_{MO} \cdot i_{M,-1} \cdot M_{-1}) \quad (32)$$

$$Ti = t_i \cdot p \cdot Y \quad (33)$$

$$Tf = t_f \cdot FT \quad (34)$$

for income, value added and profit taxes, respectively. As a consequence government savings, which constitute the budget balance, are given by:

$$Sg = Ti + Td + Tf + FC - p \cdot G - i_B \cdot B \quad (35)$$

The supply of bills by the government, which is cleared by the Central Bank as discussed in section 3.1, follows from:

$$\Delta B = - Sg \quad (36)$$

### 3.6 *The structure of the full model*

The full model is summarised in Appendix 1. One aspect of the model is to present the consolidated balance sheet for the economy in Table 6. This balance sheet combines the balance sheets presented in Tables 1- 5 above and closes some loose ends. In order to close the model we assume (as discussed above) that realised bank deposits by households close the household balance sheet and that bonds issued by banks ( $B_{ba}$ ) close the bank balance sheet. Finally the Central Bank accommodates treasury bills ( $B_c$ ) to clear the market for these bills.

Another way of looking at the structure of the model is to construct the social accounting matrix – see Table 7. This matrix presents a consistent schedule of all flows between sectors.

Value added in the production sector is obtained by producing consumption goods, government goods, accumulation of capital and the housing stock and net-exports. The proceedings are paid to households as wages ( $WB$ ), to firms as profits ( $FT$ ) and to the government as indirect taxes ( $Ti$ ). The profits of the firms, net of interest payments on loans to banks ( $i_L \cdot L$ ) and taxes on profits ( $Tf$ ), is either retained ( $FU$ ) or distributed to households as dividends ( $FD$ ).

Next to income from wages and dividends, households obtain interest on their deposits and government bills and get the remaining profits from banks. They use their income for consumption, income tax and interest payments on mortgages (using the reduced rate due to tax deductibility). The remaining part of their income is saved.

Banks obtain interest income from mortgages and loans to firms, and pay next to dividends on equity interest on advances from the Central Bank, deposits held by households and bonds issued abroad. The remaining profits are presented to households in the form of bonus payments.

The social accounting matrix shows that

$$p \cdot \Delta K + ph \cdot \Delta HS + TB + Sa = Ya \quad (37)$$

where the trade balance is  $TB = Ex - Im$  and  $Sa$  represents savings from the foreign sector. Hence holds:

$$p \cdot \Delta K + ph \cdot \Delta HS = Ya - TB - Sa = Sh + FU + Sg + i_B \cdot B_{ba} + i_E \cdot E_{ba} - TB \quad (38)$$

where  $Sh + FU + Sg$  represents domestic savings and  $i_B \cdot B_{ba} + i_E \cdot E_{ba} - TB$  represents net capital inflow. Thus capital and housing accumulation is financed by domestic savings and net capital inflow from abroad.

Finally, the change in foreign reserves is given by:

$$-\Delta R = \Delta Va - \Delta B_{ba} - \Delta(p_e \cdot E_{ba}) = i_B \cdot B_{ba} + i_E \cdot E_{ba} - TB - \Delta B_{ba} - \Delta(p_e \cdot E_{ba}) \quad (39)$$

Table 6. Balance Sheets

	Households	Firms	Banks	Central Bank	Government	Foreign	Total
High powered money	$+ H_h$		$+ H_b$	$- H$			$0$
Central Bank advances			$- A$	$+ A$			$0$
Bank deposits	$+ M$		$- M$				$0$
Loans		$- L$	$+ L$				$0$
Bills	$+ B_h$			$+ B_c$	$- B$		$0$
Capital		$+ p \cdot K$					$+ p \cdot K$
Bonds			$- B_{ba}$			$+ B_{ba}$	$0$
Equities	$p_e E_h$	$- p_e E_h$	$- p_e \cdot E_{ba}$			$+ p_e \cdot E_{ba}$	$0$
Mortgages	$- MO$		$+ MO$				$0$
Houses	$+ ph.HS$						$+ ph.HS$
Foreign Reserves				$+R$		$-R$	$0$
Total (net worth)	$+ V$	$+ V_f$	$0$	$0$	$- B$	$+Va$	$+Vt$

Table 7. Social Accounting Matrix

	Prod.	Households	Firms	Banks	Central Bank	Government	Capital Account	Foreign	Total
<b>1. Production</b>		$+ p \cdot C$				$p \cdot G$	$p \cdot \Delta K$ $+ ph. \Delta H S$	$X - IM$	$p \cdot Y$
<b>2. Households</b>	$+ WB$		$+ FD$	$+ iM + Fb$		$+ iB_h$			$+ Yh$
<b>3. Firms</b>	$+ FT$								$+ FT$
<b>4. Banks</b>		$+ i.MO$	$+ iL$						$+ Yb$
<b>5. Central Bank</b>				$+ iA$		$+ iB_c$			$+ Yc$
<b>6. Government</b>	$+ Ti$	$+ Td$	$+ Tf$		$+ Fc$				$+ Yg$
<b>7. Capital Account</b>		$+ Sh$	$+ FU$	$0$	$0$	$+ Sg$		$+ Sa$	$0$
<b>8. Foreign</b>				$+ i_B B_{ba} + i_E E_{ba}$					$+ Ya$
<b>TOTAL</b>	$+ p \cdot Y$	$+ Yh$	$+ FT$	$+ Yb$	$+ Yc$	$+ Yg$	$p \cdot \Delta K$ $+ ph. \Delta H S$	$TB + Sa$	

#### 4. Simulation results of the model

The model as described above and as fully listed in Appendix 1 is used to analyse two scenarios as depicted in the stylised facts. To obtain a baseline solution the model is first “calibrated” using a plausible set of parameters.<sup>29</sup> The stylised facts to be reproduced as baseline are export-led growth, a slight government budget deficit, a trade surplus and fiscal parameters that reflect the Dutch situation regarding tax rates in general and the fiscal policy of deducting mortgage interest payments from income tax. Since export grows at 1% exogenously, the baseline solution shows a slight positive annual growth rate of real GDP of 1% even though labour productivity is kept constant. The government deficit stabilises at around 2.5% of GDP, whereas the trade surplus remains positive and around 5% of GDP.

The simulations are carried out for 250 periods and this time span is mimicked as period 1800-2050. All graphs start in 1970 to first let the model (safely) converge to a relatively stable solution. In the scenarios described below we introduce two different periods at which these scenarios are activated. The first period starts in 1980, and the second starts in 2020.<sup>30</sup> Here we focus on two sets of scenarios both related to an increase in house prices and their impact on (1) the financial market, in particular on the deposit financing gap, and (2) the effects on consumption, GDP and the government deficit. In the baseline scenario prices of houses grow by about 1% per year whereas price of output remains stable<sup>31</sup>. In scenario a1 we change autonomous growth in house prices, represented by the parameter  $\psi_t$  in equation (4), from 0 to 0.005 from 1980 onwards such that house prices will grow by about 1.5% per year since then – as we argued in section 3.3 this can be motivated by the increasing willingness of banks to issue mortgages. While in scenario a1 the annual increase of real house prices is kept at about 1.5% until the end of the simulation, in line with the stylised facts as described in section 2, in scenario a2 the increase in house prices will stop in 2020 by returning the value of  $\psi_t$  from 0.005 back to 0 in that year such that the annual increase in house prices returns to about 1% as in the baseline scenario. Finally, in scenario a3, increase in real house prices is even more reduced in 2020 by setting the parameter  $\psi_t$  to -0.005 resulting in a growth rate of house prices of about 0.5%, so below the baseline scenario.

The second set of scenarios is similar to the first one with the main distinction that now government policy is focused on keeping the government deficit below 3% of GDP, in line with European fiscal policy rules. This is implemented by decreasing the growth rate of government expenditures if last year’s deficit exceeded 3% of GDP.<sup>32</sup> Under this condition we applied the same scenario’s as depicted in the first set by changing the value of  $\psi_t$  such that house prices grow by 1% per year (scenario b0);

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<sup>29</sup> The parameters are listed in Appendix 2.

<sup>30</sup> These dates are added merely for presentational purposes and do not reflect, nor intend to suggest, actual calendar time.

<sup>31</sup> The Wage rate is stable and output price is a mark-up on the wage rate.

<sup>32</sup> In the model real government expenditures are modeled as:  $g = g(-1) + (1 + g_{rye} + grg0)$ , where  $g_{rye}$  is expected growth rate of real output and  $grg0$  is an add factor. This add factor is zero if last year’s nominal deficit is below 3%, but it is equal to:  $grg0 = grg0(-1) - \lambda \cdot (Gdef/Y - 0.03)$ , if nominal government deficit ( $Gdef$ ) is above 3% of nominal GDP ( $Y$ ). Note that we let  $grg0$  grow towards zero with the same speed if  $grg0$  is negative and the lagged government deficit is within the bounds of 0 and 3%. The adjustment parameter  $\lambda$  is set equal to 0.5.



by 1.5% from 1980 onwards (scenario b1); by 1.5% from 1980 until 2020 and back to about 1% after 2020 (scenario b2), and by 1.5% since 1980 until 2020 and reduced to 0.5% after 2020 (scenario b3).

### 4.1 Increased house prices

If real house prices increase, we expect that household consumption will also increase because total household wealth will expand, but also because households will consume part of the excess value of houses by increasing mortgages on existing properties. This is in line with the stylised facts. As a result we expect that real consumption and real output will increase initially. Though increased output also induces employment growth this has in the current version of the model no effect on inflation such that wage inflation, output price inflation and thus expected inflation are all zero. Since interest rates are all based on a fixed spread on treasury bills or Central Bank advances and on expected inflation, these do not change between scenarios. However, demand for mortgages by households will increase and demand for loans from firms will expand to finance increased investments as a reaction on increased production. This induces banks to adjust their liabilities to accommodate these changes.

Figure 19

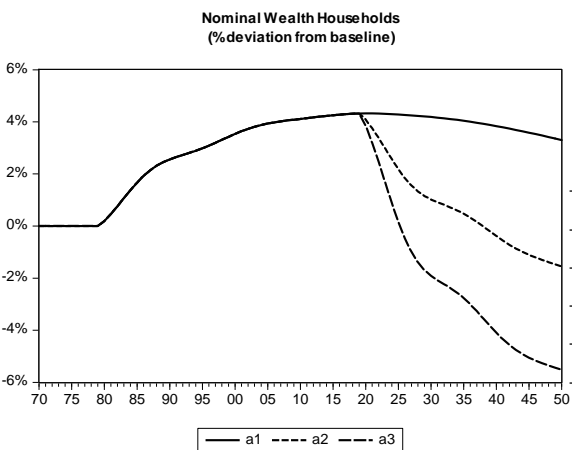


Figure 20

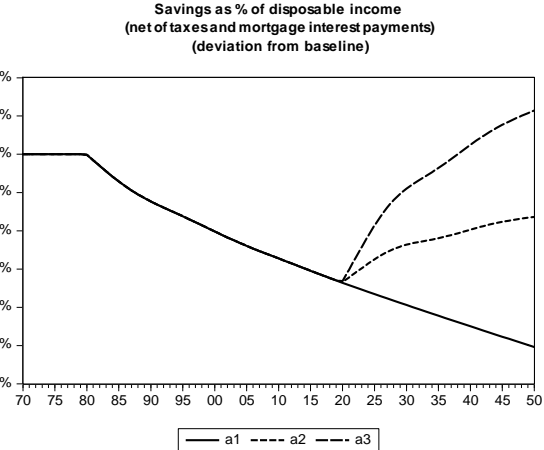


Figure 21

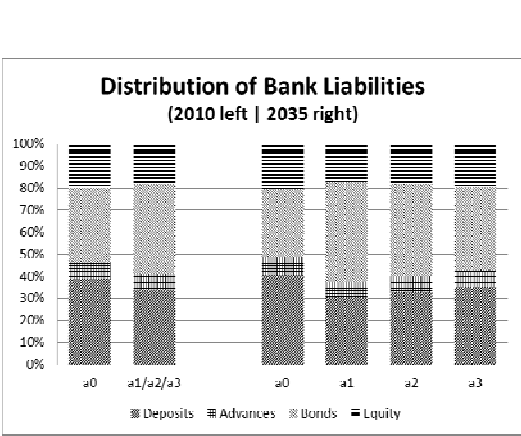
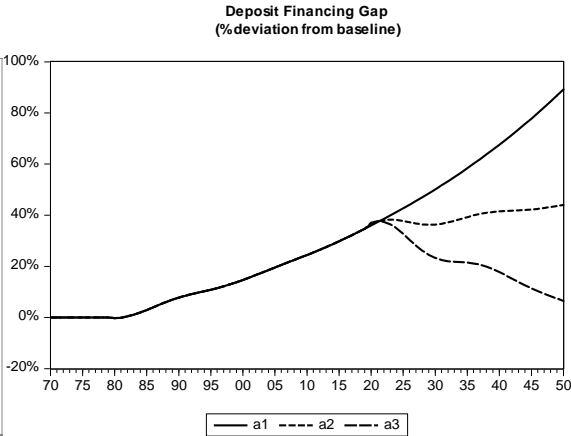


Figure 22



In scenario a1 nominal household wealth will steadily increase initially due to the increase in house prices - see Figure 19, whereas the distribution of its components hardly changes. The total fraction of value of houses minus mortgages in total household wealth increases slightly from 8% in 2010 in the baseline to 9% in that year, while decreasing the other components only marginally. In line with the second stylised fact described in section 2, household savings decline consistently due to the impact of increased wealth on consumption - see Figure 20. This leads to a small decline in deposits from 19% to 18% of household wealth. At the assets side of the bank balance sheet the amount of mortgages increase by 17% in 2010 relative to the baseline scenario whereas loans increase by 8%, together leading to an increase of the total balance sheet of 13%. Banks have to finance that in our model by selling bonds abroad – since normally equity is only issued to increase tier 1 capital (or in our model to finance bank losses). This also can be seen by comparing the two bars at the left in Figure 21 representing the relative shares of all liabilities: One sees that after the increase in house prices, the share of foreign bonds increased in 2010 from 33% in the base line to 41% in the other scenarios. However, since the increase in household wealth is a gradual process, also changes in the distribution of bank liabilities follow a gradual process. In first years after increased house prices bank profits will increase, but since banks will issue more and more bonds, which are more expensive than deposits or central bank advances, bank profits will slowly decline, after an initial positive impulse.<sup>33</sup> Bank profits eventually become negative relative to the baseline in all three scenarios, although they remain positive in an absolute sense. The deposit financing gap, which is defined as the ratio of long lending (mortgages and loans) relative to household deposits, is indeed increasing as expected, cf. Figure 22. This is consistent with the third stylised fact discussed above.

Figure 23

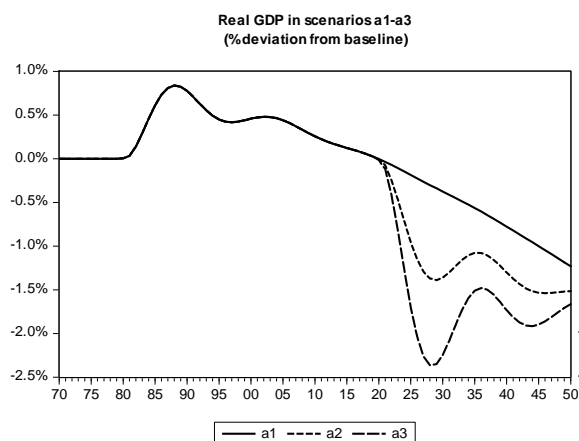
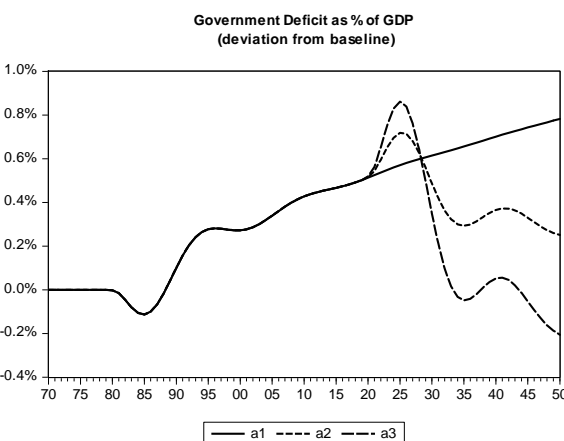


Figure 24



Finally, increased house prices will increase household consumption and thereby output – at least initially. GDP increases by nearly 1% compared to the baseline, cf. Figure 23. However, a countervailing influence follows from the ensuing increase in mortgages, which leads to an expanding interest burden such that the net income of households is reduced. The latter leads to a reduction of the initial impulse to GDP as can be seen in Figure 23. Eventually GDP will even fall below baseline GDP and continues to deviate from the baseline. The increased demand for mortgages together with the decreased household savings also forces banks to issue an increasing amount of bonds, enhancing the deposit financing gap.

<sup>33</sup> Interest on bonds is equal to 5% in all scenarios whereas the interest rate on central bank advances and on deposits is 2%.

In the baseline simulation, government expenditures are nearly stable and so is the deficit which remains about 2.5% of GDP during the entire simulation period. The growth rate of real government expenditures is proportional to the growth rate of real output and thus increases at the same pace in scenario a1. Tax income also increases, but not at the same pace since interest payments on mortgages by households is deductible from income tax. This gap will be financed by government by issuing treasury bills which are at a relative high interest rate of 4%. This increasing interest burden again increases government deficit, leading to a self-sustaining process – cf. Figure 24.<sup>34</sup> These developments are consistent with the fourth stylised fact discussed above.

Turning to scenarios a2 and a3 where prices of houses stabilise or even decrease after 70 periods we observe in Figure 19 in both cases a decrease in household wealth that ultimately turns even further below the baseline. Profits of banks even worsen compared to scenario a1 but the deposit financing gap stabilises (a2) or decreases (a3) due to increased savings and decreased demand for mortgages – see Figures 20 and 21. In both cases real GDP drops considerably compared to simulation a1 because of decreased household wealth and thus decreased consumption. Moreover, interest payments on mortgages remain high so that GDP does not reverse to its initial level. However, also in scenarios a2 and a3 growth of real GDP remains positive. The government deficit relative to GDP initially increases and rises to above 3% in all scenarios. It remains high and stays above 3% in scenario a1 but drops to about 2.8% and 2.3% in scenarios a2 and a3 respectively due to decreasing government expenditures because of decreasing growth rate of real output.

These scenarios illustrate on the one hand the link between the increasing house prices and the growth of the deposit financing gap. On the other hand they show the strong interaction between the financial sector and the real sphere.

#### 4.2 *Government deficit is limited to 3% of GDP*

The second set of scenarios reflect a situation where government policy is adapted to the so-called 3%-rule. This rule is highly debated under the current circumstances as it might harm recovery of the downturn as experienced by many countries after the crisis in 2008. The baseline scenario is not affected since the budget deficit remains below 3%, hence all baseline results remain the same. However, in the other scenarios the deficit tends to exceed 3%, hence the rule is activated that government expenditures decrease if deficit increases above 3% of GDP.

In scenario b1 where the house price increases by 1% per year, the deficit limit is encountered in 2015 whereas it remains below the 3% limit in the baseline scenario. In 2016 a drop in government expenditures is imposed. This indeed reduces the deficit as can be seen in Figure 26 (as compared to Figure 24 above). As a consequence real GDP also drops and turns below real GDP in scenario a1 – compare Figure 25 to Figure 23 above (note that Figure 25 has a lower minimum).

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<sup>34</sup> In our model the deficit is financed by the Central Bank, partly because the Central Bank absorbs all bills issued by government, partly because the profits resulting from interest payment on these bills are transferred to the government.

Figure 25

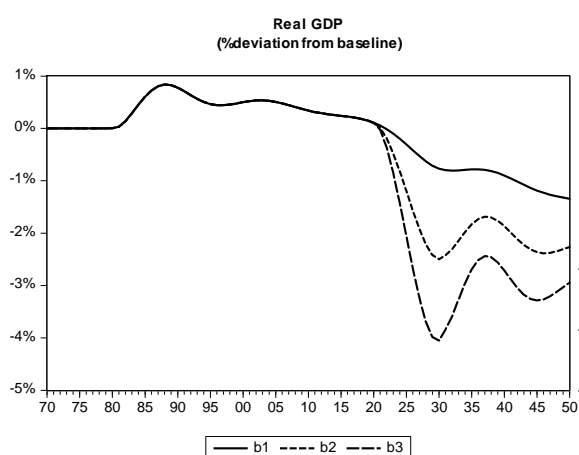
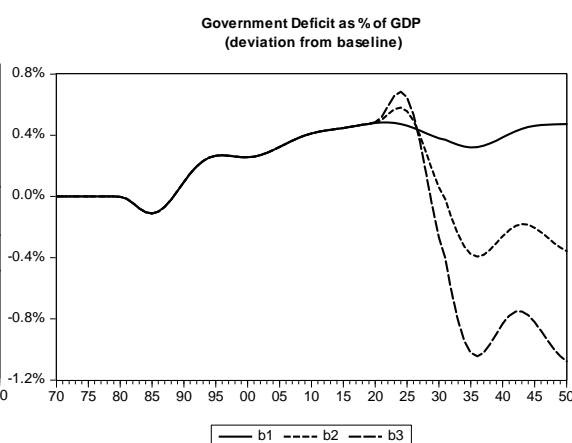


Figure 26



In case of stabilising house prices (scenario b2) and decreasing house prices (b3) the effect even becomes larger since decreasing consumption due to decreased wealth effects is now coupled with cuts in government expenditures. Reduction of government expenditures now causes GDP to drop even more, to 4% below the baseline in scenario b3, whereas without budgetary rule this would be about 2%. Because of this development the government deficit drops further in scenarios b2 and b3 – compare Figures 24 and 26.<sup>35</sup> In these latter two scenarios the working of the automatic stabiliser is hampered by the 3% rule, which is consistent with the finding of Candelon, Muysken and Vermeulen (2009) for the euro area countries.

These scenarios show that too stringent a budget policy may have adverse effects.

## 5. Concluding remarks

In this paper we observed some interesting stylised facts for the Netherlands, which emphasise on the one hand a strong potential for interaction between the financial and the real sphere, and on the other hand point at the danger of a second Dutch disease, which might be relevant for other countries to be aware of. The core of the problem is formed by the deposit financing gap, which forces the banking sector to finance its outstanding long-term commitments, in particular mortgages, with short-term funding or bonds, mainly taken from abroad. As a consequence the banks have to pay a relatively high interest rate and their source of financing is uncertain.

This problem is aggravated by increasing house prices, which led to an explosive growth in mortgages (also stimulated by tax deductions on mortgage interest payments) and cumulated in a housing bubble. The existence of such a bubble is only grudgingly recognised in the Dutch debate and we show in our discussion in section 2 how this bubble slowly started in the early 1990s. We also show the fall-out of the recent bursting of the bubble, leading to a double-dip recession and worsening government deficits.

<sup>35</sup> In the last scenario where house prices drop and where government policy sticks to the 3% rule we see even negative growth of GDP during three consecutive years (2023-2025), indeed mimicking the double dip as described in the stylized facts.

In our opinion the current macroeconomic models, including the new-Keynesian models, are not able to explain the stylised facts in a satisfactory way. In particular they do not provide a satisfactory perspective on the interaction between the real sphere and the financial sector, which is crucial in analysing the dynamics and the impact of the deposit financing gap. Nor can they explain in full the impact of the decrease in house prices on the financial sector and the real sphere (and in particular on their interaction). We therefore develop in section 3 a model in the stock flow consistent tradition which shows the importance of wealth effects in consumption, in relation to wealth accumulation, and takes into account the role of the financial sector in that process.

Our model is based on the model developed by Zezza and Dos Santos (2006) and elaborated to include the housing sector in Zezza (2008). However, to analyse the Dutch situation we have included a foreign sector in the model, and we have elaborated the model of the banking sector considerably in order to be able to model the emergence of the deposit financing gap. The properties of this model have been analysed in simulations in section 4. We show how an increase in house prices can lead to the emergence of the deposit financing gap, which then hampers economic growth because of the burden of financing that gap. Moreover, the subsequent stagnation or fall in house prices leads to a fall in GDP growth through negative wealth effects, while the burden of the deposit financing gap still weighs on the economy too. It is obvious that there is also a negative impact on the government deficit, through the working of the automatic stabiliser. Finally we show that in some cases the working of the automatic stabiliser is hampered by strictly imposing the 3%-budget deficit boundary, leading to a further deterioration in economic growth.

Although the model in its current version already provides interesting insights, we plan at least two extensions to describe the Dutch situation in a more comprehensive way. First we intend to model explicitly the role of pension funds next to the banking sector in the financial sector, and to include the impact of aging on both consumption behaviour and on the funded pension system. Next to that we also want to pay explicit attention to the unemployment problem and on the interaction of unemployment with wage formation and social security. However, these issues are left for further research. For the moment we are content to be able to explain with a relatively simple model how the danger of a second Dutch disease in the form of the deposit financing gap has emerged. And to show how such a phenomenon through the interaction between the financial and the real spheres can destabilise the whole economy.

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## Appendix 1 The full model

### GDP components

$$SK = \text{CONSK} + \text{IK} + \text{IHK} + \text{GK} + \text{EXK} - \text{IMK}$$

$$S = SK * p$$

$$\text{CONS} = \text{CONSK} * p$$

$$I = \text{IK} * p$$

$$G = \text{GK} * p$$

$$\text{IMK} = \text{IM} / p$$

$$\text{EXK} = \text{EX} / p$$

$$\text{TB} = \text{Ex} - \text{Im}$$

### Foreign sector

$$\text{EX} = X\_EX$$

$$\text{IM} = p\_im * S$$

$$\text{deltaR} = \text{TB} + (\text{Bba} - \text{Bba}(-1)) + (pe * \text{Eba} - pe(-1) * eBA(-1)) - rb * \text{Bba} - \text{FBA}$$

$$R = R(-1) + \text{deltaR}$$

$$Va = \text{Eba} * pe + \text{Bba} - R$$

### Household sector

$$\text{YH} = W + \text{FD} + rm(-1) * M(-1) + \text{FB} + rb(-1) * Bh(-1)$$

$$\text{YHT} = \text{YH} - \text{DT}$$

$$Y = \text{YHT} - rmo(-1) * MO(-1)$$

$$\text{YE} = Y(-1) * (1 + g_{rye}) * (1 + \text{in fle})$$

$$\text{DT} = p\_dtrate * (\text{YH} - p\_taumo * rmo(-1) * MO(-1))$$

$$\text{YK} = Y / p$$

### Wealth and its components

$$V1 = \text{Hh} + M + Bh + E * pe + ph * \text{Hs} - MO$$

$$\text{VK} = V / p$$

$$\text{HH} = p\_hh * \text{CONS}$$

$$M = V - \text{HH} - Bh - E * pe - ph * \text{Hs} + MO$$

$$Bh = \text{vpar1} * (V - \text{HH})$$

$$\text{vpar1} = p\_lam10 + p\_lam11 * rrm + p\_lam12 * rree + p\_lam13 * (Ye / Ve) + p\_lam14 * p\_rrb$$

$$rree = re + p\_thetare * (ree(-1) - re(-1))$$

$$rree = (1 + rree) / (1 + \text{in fle}) - 1$$

$$pe = (\text{vpar2} * (V - \text{HH}) - p\_seq * (I - Fu)) / E(-1)$$

$$\text{vpar2} = p\_lam00 + p\_lam01 * rrm + p\_lam02 * rree + p\_lam03 * (Ye / Ve) + p\_lam04 * p\_rrb$$

$$\text{DHS} = X\_HS - X\_HS(-1)$$

$$\text{HS} = \text{HS}(-1) + \text{DHS}$$

$$g\_ph = p\_phi\_sent + p\_thetapha * (\text{YHT} / \text{YHT}(-1) - 1) + (1 - p\_thetapha) * (Ye / Ye(-1) - 1) - ((rmo * (1 - p\_dtrate * p\_taumo) + p\_phi\_rep) / (rmo(-1) * (1 - p\_dtrate(-1) * p\_taumo(-1)) + p\_phi\_rep(-1)) - 1) - p\_phi\_h * (\text{HS} / \text{HS}(-1) - 1)$$

$$ph = ph(-1) * (1 + g\_ph)$$

$$\text{vhs} = ph * \text{hs}$$

$$\text{DMO} = p\_phi1 * ph * \text{DHS} + p\_phi2 * (ph - ph(-1)) * \text{HS} - \text{morc}$$

$$MO = MO(-1) + \text{DMO}$$

$$V = V(-1) + Y - \text{CONS} + \text{CG} + \text{CGH}$$

Real sales

Nominal Sales

Nominal Consumption

Nominal investments

Nominal Government Consumption

Real Imports

Real Exports

Trade balance

Nominal Exports (Exog.)

Nominal Imports

Change in foreign reserves

Stock of foreign reserves

Wealth held by foreigners (Wealth abroad)

Nominal total income

Disposable income net of taxes, not net of mortgage interest payments

Disposable nominal income

Expected disposable nominal income net of taxes

Direct Tax (income tax)

Disposable real nominal income net of taxes

Total (nominal) wealth household sector (check)

Total real wealth household sector

High powered money held by households

Stock of bank deposits

Stock of Treasury Bills held by households

Treasury Bills fraction in portfolio distribution

Expected nominal returns on equities

Expected Real returns on equities

Market price of equities

Equity fraction in portfolio distribution

Change in stock of houses

Stock of houses

Growth rate of nominal house prices

Price of houses

(Nominal) value of houses

Changes in Mortgages

Mortgages

Total (nominal) wealth household

$$CG=(pe-pe(-1))*E(-1)$$

$$CGH=(ph-ph(-1))*HS(-1)$$

$$VE=V(-1)+YE-CONS+CGE+CGHE$$

#### **Consumption and savings**

$$CONSK=p\_a1*YK+p\_a2*VK(-1)+p\_a3*(vhs-MO)/(p+p\_a4*(CGKE+CGKHE)-p\_a4*infl*vk(-1)/(1+infl))$$

$$pee=pe(-1)*(1+pege)$$

$$pege=pe(-1)/pe(-2)-1+p\_thetape*(pege(-1)-(pe(-1)/pe(-2)-1))$$

$$CGE=(pee-pe(-1))*E(-1)$$

$$CGKE=(pee-pe(-1))*E(-1)/(p(-1)*(1+infl))$$

$$phe=ph(-1)*(1+pegh)$$

$$pegh=ph(-1)/ph(-2)-1+p\_thetaph*(pegh(-1)-(ph(-1)/ph(-2)-1))$$

$$CGHE=(phe-ph(-1))*HS(-1)$$

$$CGKHE=(phe-ph(-1))*HS(-1)/(p(-1)*(1+infl))$$

$$infl=p/p(-1)-1$$

$$infl=infl(-1)+p\_thetap*(infl(-1)-infl(-1))$$

$$Sh=Y-CONS$$

#### **Firm sector**

##### **The production structure**

$$prodg=p\_prodg0+p\_shockprod$$

$$prod=prod(-1)*(1+prodg)$$

$$N=SK/prod$$

$$sfc=p\_lambda*KK$$

##### **Investment and capital accumulation**

$$KK=(1+gr)*KK(-1)$$

$$K=KK*p$$

$$gr=p\_gr0+p\_gr1*rfc(-1)-p\_gr2*rrl(-1)*lev(-1)+p\_gr3*q(-1)+p\_gr4*(u(-1)-p\_unorm)$$

$$rfc=fu/k(-1)$$

$$lev=L/K(-1)$$

$$q=(L+pe*E)/K(-1)$$

$$u=sk/sfc(-1)$$

$$IK=KK-KK(-1)$$

$$IHK=ph/p*DHS$$

##### **Wage and price formation**

$$inflw=infl+prodge+inflw0$$

$$prodge=prodg(-1)+p\_thetapr*(prodge(-1)-prodg(-1))$$

$$p=(1+p\_ro)*wage/(prod*(1-p\_tau))$$

$$W=wage*N$$

$$wage=wage(-1)*(1+inflw)$$

$$UN=LF-N$$

$$UR=UN/LF$$

##### **Profits, loans and equity**

$$FT=S-W-IT$$

$$IT=p\_tau*S$$

$$TF=p\_tfrate*FT$$

sector

Nominal Capital Gains on Equities

Nominal Capital Gains on houses

Expected nominal wealth

Real consumption

Expected prices on equities

Expected Growth rate Equity prices

Expected Nominal Capital Gains on Equities

Expected Real Capital Gains on Equities

Expected prices of houses

Expected growth rate of house prices.

Expected Nominal Capital Gains on houses

Expected Real Capital Gains on houses

Rate of Inflation

Expected Rate of Inflation

Nominal Savings

Growth Rate Labour Productivity

Labour productivity

Employment

Full capacity real capital stock

Real capital stock

Nominal Capital Stock

Growth rate capital stock

Cash Flow Ratio

leverage

Tobins q

Rate of Capacity Utilisation

Real investments

Investment in housing

Wage inflation

Expected productivity growth

Price level

Wage sum

Wage rate

Unemployment

Unemployment rate

Gross Profits

Indirect Tax (sales tax)

Tax on profits



$$FD=(1-p\_ret)*(FT-rl(-1)*L(-1)-TF)$$

$$FU=FT-rl(-1)*L(-1)-FD-TF$$

$$E=E(-1)+p\_seq*(I-Fu)/pe$$

$$L=L(-1)+I-FU-pe*(E-E(-1))$$

$$Vf=p*K-L-pe*E$$

#### Government sector

$$gk=gk(-1)*(1+grye+grg0)$$

$$gry=sk/sk(-1)-1$$

$$grye=gry(-1)+p\_thetagr*(grye(-1)-gry(-1))$$

$$GD=(G+rb(-1)*B(-1))-GI$$

$$B=B(-1)+GD$$

$$GI=IT+DT+TF+Fc$$

$$grg0=@recode(gd(-1)/s(-1)>0.03and@year>1970,grg0(-1)-0.5*(gd(-1)/s(-1)-0.03),@recode(grg0(-1)<0andgd(-1)>0,grg0(-1)-0.5*(gd(-1)/s(-1)-0.03),0))$$

#### Central Bank

$$rc=(1+p\_rrc)*(1+(1-p\_thetap)*infl(-1)+p\_thetap*infle(-1))-1$$

$$rb=(1+p\_rrb)*(1+(1-p\_thetap)*infl(-1)+p\_thetap*infle(-1))-1$$

$$H=Hh+Hb$$

$$Bc=B-Bh-Bb$$

$$Bc1=H-Lc-R$$

$$Lc=p\_alpha*M$$

$$Lc1=Hb-M+L+Bb-Bba-Eba*pe+MO$$

$$FC=rc(-1)*Lc(-1)+rb(-1)*Bc(-1)-FBloss$$

#### Banking sector

$$rmo=rb+p\_spread\_rmo$$

$$rba=rb+p\_spread\_rba$$

$$rl=rc+p\_spread\_rl$$

$$rm=rc+p\_spread\_rm$$

$$rrm=(1+rm)/(1+infle)-1$$

$$rrl=(1+rl)/(1+infle)-1$$

$$HB=p\_hb*M$$

$$Eba=Eba(-1)+dEba$$

$$BB=0$$

$$Bba=Hb+L+Bb+MO-Lc-M-Eba*pe$$

$$dEba=@recode(dEba1>dEba2,dEba1,dEba2)$$

$$dEba1=@recode(FBT<0,-FBT/pe,0)$$

$$dEba2=p\_basel*(MO+L+Bb)/pe-Eba(-1)$$

$$FBT=rl(-1)*L(-1)+rb(-1)*Bb(-1)+rmo(-1)*MO(-1)-(rm(-1)*M(-1)+rc(-1)*Lc(-1)+rba(-1)*Bba(-1))$$

$$FBSA=re*pe(-1)*EBA(-1)$$

$$re=(FD)/(pe(-1)*e(-1))$$

Dividends from firms

Retained profits

Stock of Equities

Stock of loans

Total net wealth of firms

Real Government Expenditure

Growth rate of real output

Expected growth rate output

Government Deficit

Stock of Treasury Bills, Total

Government Income

Growth of government consumption additional to a constant fraction of expected output growth (second set of scenario's)

Nominal interest rate on Central Bank advances

Nominal interest rate on Treasury bills

High powered money issued by Central Bank

Stock of Treasury Bills held by central bank

Stock of Treasury Bills held by central bank (check)

Central bank Advances (A in model)

Central bank Advances (check) (A in model)

Central Bank profits

Interest on mortgages

Interest rate on bonds issued by banks to foreigners

Nominal interest rate on loans

Nominal interest rate on deposits

Real interest rate of deposits

Real interest rate on loans

High powered money held by banks

Equities issued by banks and held abroad

Stock of Treasury Bills held by banks

Bank bills held abroad (by foreigners)

Change in equities issued by banks and held abroad

Change in equities issued by banks as needed to finance losses

Change in equities issued by banks as required by Basel rules

Total bank profits

Bank profits paid to foreigners if not restricted by actual profits

Nominal dividend on equities

$FBA = @recode(FBT > FBSA, FBSA, @recode(FBT > 0, FBT, 0))$

$FB = @recode(FBT > FBSA, FBT - FBSA, 0)$

$FBloss = @recode(FBT < 0, -FBT, 0)$

$dfg = (MO + L) / M$

$moy\_ratio = MO / Y$

#### **Total wealth**

$V_t = V + V_f - B + V_a$

$V_{t1} = p * K + ph * HS$

Bank dividends paid to foreigners

Profits from Banks to households

In case of negative profits CHECK

Deposit Financing Gap

Mortgages as percentage of disposable income

Total Wealth

Total Wealth (as accumulated fixed capital)

## Appendix 2 Parameter values

name	value	description
p_grlf	0.0065	growth rate labour force
p_a1	0.8	consumption function
p_a2	0.025	consumption function
p_a3	0.035	consumption function
p_a4	0.08	consumption function
p_alpha	0.2	central bank advances ratio
p_im	0.5	imports as fraction of sales
p_ex0	3000	exports are exogenous, start level plus growth
p_grex	0.01	export growth
p_gr0	-0.05	investment function
p_gr1	2	investment function
p_gr2	1	investment function
p_gr3	0.2	investment function
p_gr4	0.4	investment function
p_lambda	1.3	full capacity production, capital output ratio
p_ret	0.1	retained profits
p_ro	0.4	mark-up
p_dtrate	0.25	tax rates
p_tau	0.13	Indirect Tax Rate (sales tax)
p_tfrate	0.35	Profit tax rate
p_thetagr	0.75	expectations
p_thetap	0.75	expectations
p_thetape	0.75	expectations
p_thetapr	0.75	expectations
p_thetare	0.75	expectations
p_thetaph	0.75	expectations
p_thetapha	0.75	Share of current income in growth house prices
p_hh	0.25	Cash
p_hb	0.25	Cash
p_seq	0.25	share of investment financed by issuing equities
p_lam00	0.3	Parameter in asset demand function
p_lam01	-0.3	Parameter in asset demand function
p_lam02	0.25	Parameter in asset demand function
p_lam03	-0.01	Parameter in asset demand function
p_lam04	-0.1	Parameter in asset demand function
p_lam10	0.43	Parameter in asset demand function
p_lam11	-0.45	Parameter in asset demand function
p_lam12	-0.25	Parameter in asset demand function
p_lam13	-0.01	Parameter in asset demand function
p_lam14	0.25	Parameter in asset demand function
p_rrc	0.02	Real interest on central bank advances
p_rrb	0.04	Real interest on treasury bills
p_spread_rl	0.015	Banks spreads
p_spread_rm	0	Banks spreads
p_spread_rmo	0.01	Banks spreads
p_spread_rba	0.01	Banks spreads
p_basel	0.08	Required bank equities as fraction of total liabilities
p_phi1	0.8	Mortgage ratio on new houses and on
p_phi2	0.8	Mortgage ratio on price changes all houses
p_tau	0.6	part of mortgage interest payments that is deductible from tax
p_phi_rep	0.033	Mortgage repayment rate (so repay in 30 years)
p_phi_sent	0.00	Sentiment in house price equation
p_phi_h	1	House price elasticity

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